Speculative markets dynamics : an econometric analysis of stock market and foreign exchange market dynamics

Chapter 7

Summary and Discussion

7.1 Summary and Discussion

The focus of this dissertation has been on the time-series properties of certain financial assets, which, until recently, has been a neglected area in Financial Economics, see Gibbons (1987). We have started from the notion that conditional moments emerging from an asset's conditional distribution are time-varying. The pricing of financial assets obviously has to be such that these changing moments are accounted for. One immediate problem that arises then is that although much of modern finance theory is set in continuous time, financial time series are only available at discrete time intervals. This implies that in an empirical assessment of time-varying conditional moments, one has to resort to a discrete time setting. In this dissertation we have subjected the most popular approach to describe time-varying conditional second moments in discrete time, the GARCH approach, to close scrutiny. We have presented substantial evidence in favor of the use of the GARCH process as a econometric tool to describe conditional heteroskedasticity in the stock and foreign exchange market. The second major objective of this dissertation was concerned with the use of a GARCH process as an economic tool in the determination of time-varying risk premia. The evidence regarding this issue is less clear-cut. The major results of the individual chapters are given below.

Chapters 2, 3, and 4 are concerned with the stock market and Chapters 5 and 6 with the foreign exchange market. Chapters 2 and 5 discuss the use of GARCH models as an econometric tool, whereas the remaining chapters discuss the usefulness of GARCH as an economic tool.

In Chapter 2, a GARCH(1,1) model is used, under various distributional assumptions to describe the evolution in the conditional variance for a broad set of returns of weekly and monthly stock indices. The preliminary analysis showed that the usual Lagrange Multiplier test to detect (G)ARCH effects has to be doubted when the underlying distribution is non-normal. A test for conditional heteroskedasticity that is based on homogeneous Markov Chains appears to be an appropriate alternative. The estimation results reveal that for both weekly as well as monthly returns, GARCH effects are clearly present. The choice of the conditional distribution is limited to three alternatives. We employed a conditional Normal, a conditional Student t-distribution, and a Generalized Error or Power Exponential distribution. Generalized Likelood Ratio tests clearly point in one direction. The Student t-distribution is the preferred alternative both for weekly as well as monthly returns. Conditional normality can be dismissed altogether. Furthermore we conclude that aggregation from a weekly to a monthly level is insufficient to cause conditional heteroskedasticity of the GARCH form to disappear. Our monthly estimates are broadly consistent with the estimates implied by an aggregation theorem developed by Drost and Nijman (1991). Finally the unconditional distribution of rescaled GARCH residuals is definitely non-normal, and the evidence presented by a tail-index analysis, see Koedijk, Schafgans and de Vries (1990), suggests an unconditional Student t-distribution with few degrees of freedom.

Chapter 3 considers the implementation of a GARCH model for the conditional variance of the market return into an intertemporal asset pricing model for stock returns. In the initial analysis of this chapter we have derived an asset pricing model containing both the traditional CAPM as well as Consumption CAPM elements, on the basis of Generalized Isoelastic Preferences. In order to arrive at an "assets-only" model we had to eliminate consumption growth from the model. In a heteroskedastic world this is not at all trivial. It was assumed that the intercept term in the linear relation between expected consumption growth and the expected market return depends linearly on the conditional variance of the market return, which is modelled by a GARCH process. An intermediate result in the analysis was that modelling the conditional variance as a GARCH process does not result in the familiar GARCH-in-mean model. The resulting asset pricing model is reminiscent of a three moment CAPM, and includes a time-varying conditional third moment. This indicates that besides a risk-return tradeoff, we should also be concerned with a risk-skewness tradeoff.

In Chapter 4 we were not only concerned with time-varying second moments, but also with time-varying third moments. This concern was inspired by the results of Chapter 3. The market version of the model developed in that chapter was subjected to an empirical analysis, using the same dataset as in Chapter 2. In a calibration exercise we have shown that our model is capable of generating plausible values for the parameters of interest. Subsequently we have introduced the Generalized AutoRegressive Conditional Skewness (GARCS) process, in order to model time-varying conditional third moments. The full model was estimated by GMM as we did not wish to make any distributional assumptions, and we compared the results to the results obtained from a GARCH-in-mean model. Our version of the three-moment CAPM generates significant estimates for the coefficient of relative risk aversion, whereas the GARCH-in-mean model does not. This can be explained by the lack of intertemporal components in the GARCH-in-mean model. We have also found a high degree of correlation between the conditional variance and the conditional third moment, which is a common problem in the existing literature on the three moment CAPM. In Chapters 3 and 4 we have shown that incorporating GARCH into an asset pricing model is not at all as straightforward as the GARCH-in-mean model led us to believe, and the issues discussed in these chapters provide sufficient incentives for future research.

The statistical properties of weekly exchange rate returns within the Exchange Rate Mechanism of the EMS were analyzed in Chapter 5. Our preliminary analysis shows that these exchange rate returns are characterized by highly leptokurtic distributions, and high degree of mean reversion between parity adjustments. Without parity adjustments the martingale hypothesis could not be rejected. Again conditional heteroskedasticity is clearly present, but besides the risk factor represented by the conditional variance of ordinary diffusion another risk factor is present, namely realignment risk. In our analysis this is accounted for by an independent Poisson Jump process. More specifically, the model that is most successful in capturing the relevant features of EMS exchange rate returns, and in generating the most plausible values for the jump parameters, is a combined Jump-GARCH model with conditionally Student t-distributed innovations.

Chapter 6, as Chapters 3 and 4 before, addressed the issue of time-varying risk premia for financial asset returns, and considered the conditional variance of foreign exchange rate returns, given by a GARCH process, as a determinant of the risk premium in the forward foreign exchange market. The rejection of the forward rate as an unbiased predictor of the expected future spot rate can be attributed to the irrationality of market participants or the existence of a time-varying risk premium. The use of a survey dataset in which direct expectations regarding future exchange rates were formed, relieves us from the assumption of rational expectations. Many theoretical models generate a risk premium that depends on the conditional probability distribution of the future spot rate. This provides the rationale for a consideration of the conditional variance of the exchange rate return as a determinant of a time-varying risk premium. Contrary to our findings in Chapter 4 for the stock market, the estimation results in this chapter indicate that the GARCH-in-mean model is reasonably successful in describing a time-varying risk premium.

As a general remark, we should mention that all of our analyses could alo be cast in a multivariate framework. This dissertation has focused on a univariate "time-series" approach, while many interesting issues in asset pricing theory require a multivariate or "cross-sectional" approach. This is particularly relevant for the analyses in Chapters 4 and 6. The asset pricing model that was developed in chapter 3 should be examined for a cross-section of individual assets, in order to provide further evidence regarding its strengths and weaknesses. The determination of the risk premia in the forward foreign exchange market could be cast in a multivariate GARCH setting, where a system of exchange rates can be analyzed simultaneously. For such a multivariate GARCH approach, with high frequency and symmetrically distributed data, the use of a conditional multivariate Student t-distribution should be seriously considered, see chapter 2.

Our analyses in Chapters 5 and 6 could be combined to assess the impact of jumps on the risk premium in the forward foreign exchange market. Alternatively the Jump-GARCH models presented in Chapter 5 could be extended to allow for a jump intensity parameter that depends on the position of the exchange rate within the band. Finally it should be possible to check whether our evidence in favor of the GARCH-in-mean model in Chapter 6, where GARCH is treated as a reduced form of a more complicated dynamic structure for time-varying conditional second order moments, still holds up if we would incorporate GARCH directly into an asset pricing model, as was the case in Chapter 3.